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## Adaptability of Forage Species for Pinyon-Juniper Sites in New Mexico

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Southwestern ranchers and range managers are interested in seeding deteriorated ranges in the pinyon-juniper type. They are especially interested in seeding areas where the trees have been removed. Knowledge about forage species suitable for seeding such ranges is scanty.

This Note reports the adaptability ratings of 40 species of grass, 2 forbs, and 1 shrub at 5 pinyon-juniper sites in New Mexico. Small test plots were seeded during 1946-48, and evaluated until 1962.

The sites are widely separated geographically, and are different environmentally because of differences in elevation, annual precipitation, distribution of precipitation, length of growing season, soil texture, and principal understory plants (table 1). Weather records by years are not available.

### Methods

The test seedings were made in small plots on plowed ground. A plot consisted of three

12-foot rows, 1 foot apart. Two or more plots of every species were randomly selected at each site. Rows were made with hand tools, and the seeds were planted by hand during June and July. Rate of seeding usually was 20 to 30 seeds per foot of row. Seeds were covered with about 1/2 to 1 inch of soil. Wild plants were hoed from between the seeded rows during the first 2 years, after which the native vegetation was allowed to reestablish in the test plots.

The success of the seeding in each plot was rated at least twice a year from 1946 to 1952, once in 1954, and once in 1962. The following rating system, described by Hull<sup>2</sup> was used:

0	failure
1- 2	very poor
3- 4	poor
5- 6	fair
7- 8	good
9-10	excellent

The above numerical ratings were assigned in the field on the basis of number, distribution, and vigor of plants in the test rows. The rating represents the actual stand in relation to the best possible stand.

<sup>1</sup>Range Scientist, located at Albuquerque, in cooperation with the University of New Mexico; central headquarters are maintained at Fort Collins, in cooperation with Colorado State University.

<sup>2</sup>Hull, A. C., Jr. Rating seeded stands on experimental range plots. Jour. Range Mangt. 7: 122-124, illus. 1954.

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Table 1. --Description of study sites in pinyon-juniper type, New Mexico

Study site	Elevation	Precipitation		Length of growing season	Soil texture	Principal understory plants
		Annual	October through March			
	Feet	Inches	Percent	Days		
Glorieta Mesa	7,200	15	29	140	Sandy loam	Blue grama, western wheatgrass
Monica	7,500	12	29	123	Gravelly loam	Blue grama, ring muhly
Corona	6,300	15	30	175	Loam	Blue grama, western wheatgrass
Fort Bayard	6,300	14	33	194	Clay loam	Blue grama, side-oats grama
Taos Junction	7,200	13	37	146	Sandy loam	Big sagebrush, blue grama

Many seedlings failed to produce satisfactory seedling stands. Species were judged to have been inadequately tested unless the stand rated fair or better within 1 year after seeding. Species likewise were not considered adequately tested when the stands were destroyed by rodents or rabbits.

### Results

Species adaptability ratings are given in table 2, which lists all species adequately tested at one or more of the study sites. Species which persisted at the study sites for 14 to 16 years presumably met crucial tests of climatic adaptability. Winter temperatures in 1948 and 1949 were unusually low for the State as a whole, and precipitation in 1956 was the lowest on record.

The seeded species that rated fair or better in 1962 also had met other tests, including resistance to competition from other plants and to possible destruction by animals. At each of the sites the native plants gave increasingly greater competition through the years, especially at the Glorieta Mesa and Corona sites where western wheatgrass competed strongly with the seeded plants. Also,

periodic observations at each site showed varying degrees of activities by ants, grasshoppers, gophers, rats, mice, cottontails, jackrabbits, and deer--all potential detriments to survival of the test seedlings.

Introduced cool-season grasses, including Agropyron cristatum, A. desertorum, A. sibiricum, and Elymus junceus, grew well at the Taos Junction site. This site receives proportionately more winter precipitation than the other four, and is the only one of the sites where big sagebrush is a principal understory plant. The introduced cool-season grasses failed to persist at the Monica and Corona sites, which indicates lack of adaptability to environmental conditions there. They also failed to persist at the Glorieta Mesa site, where gophers destroyed the seeded stands before the species were adequately tested. The introduced wheatgrasses grew well for several years at the Fort Bayard site, but they gradually declined in vigor and failed to reproduce.

Seeded stands of Agropyron smithii, a native wheatgrass, survived at all five study sites and rated fair at four of the sites. The so-called "sand strain" showed no advantages over a regular commercial source.

Table 2. --Adaptability ratings<sup>1</sup> for species tested at one or more pinyon-juniper study sites in New Mexico--  
planted 1948-49; evaluated 1950, 1954, 1962

Species	Glorieta Mesa			Monica			Corona			Fort Bayard			Taos Junction		
	1950	1954	1962	1950	1954	1962	1950	1954	1962	1950	1954	1962	1950	1954	1962
<i>Agropyron cristatum</i>	E	X		P	O		G	P	O	G	F	P	G	G	F
<i>desertorum</i>	G	X		F	O		F	P	O	G	F	P	G	E	G
<i>elongatum</i>	G	X		P	O		F	O		F	P	O	O		
<i>inerme</i>	F	X		F	O		F	O		--			G	F	P
<i>intermedium</i>	F	X		P	O		F	P	O	G	F	F	F	F	O
<i>sibiricum</i>	G	X		F	O		G	P	O	G	F	P	G	E	G
<i>smithii</i>															
Commercial	F	F	F	F	P	P	F	F	F	F	F	F	F	F	F
Sand	G	P	P	--			--			F	F	F	F	G	F
<i>trachycaulum</i>	O			P	O		F	O		--			F	O	
<i>trichophorum</i>	G	X		P	O		F	P	O	F	F	P	G	F	P
<i>Andropogon barbinodis</i>	--			--			--			P	P	F	--		
<i>caucasicus</i>	--			--			--			P	P	F	--		
<i>ischaemum</i>	--			F	P	O	G	G	G	--			--		
<i>Atriplex canescens</i>															
Las Cruces	--			G	E	E	E	G	F*	P*	P	P	G	P*	P
Taos	E	E	G	E	E	E	G	G	F*	G	G	G	G	G	G
<i>Bouteloua curtipendula</i>	--			P	O		F	P	F	--			--		
<i>eriopoda</i>	--			--			--			--			P	O	
<i>gracilis</i>															
Capulin	--			G	G	F	G	G	F	--			G	F	F
Commercial	--			F	P	P	F	P	P	--			F	G	F
Lovington	--			G	F	P	G	G	F	--			E	G	F
<i>Buchloe dactyloides</i>	--			P	O		P	P	P	--			P	F	F
<i>Elymus glaucus</i>	O			--			F	O		--			G	P	O
<i>juncus</i>	F	F	O	F	O		F	P	P	--			E	G	G
<i>Eragrostis chloromelas</i>	O			O			P	P	O	P	P	F	O		
<i>curvula</i>	--			O			F	P	O	G	P	F	O		
<i>lehmanniana</i>	O			O			O			G	P	O	O		
<i>trichodes</i>	--			F	O		G	F	P	--			--		
<i>Festuca ovina</i>	F	O		--			--			--			F	P	P
<i>Hilaria jamesii</i>	--			--			F	F	F	--			--		
<i>Lycurus phleoides</i>	--			--			F	X		--			--		
<i>Melilotus alba</i>	F	O		P	O		--			--			--		
<i>officinalis</i>	G	O		F	O		F	O		--			--		
<i>Muhlenbergia wrightii</i>	G	F	X	G	G	F	E	G	F	--			--		
<i>Oryzopsis hymenoides</i>	--			F	X		F	X		--			G	F	F
<i>Panicum obtusum</i>	--			F	O		F	G	F	--			--		
<i>Poa ampla</i>	--			--			--			--			F	P	O
<i>Secale montanum</i>	F	O		F	O		F	O		--			F	O	
<i>Setaria macrostachya</i>	--			P	P	O	P	P	P	F	F	P	--		
<i>Sporobolus airoides</i>	--			G	E	G	P	F	G	--			--		
<i>contractus</i>	--			G	F	P	--			--			--		
<i>cryptandrus</i>	F	P	P	G	F	F	G	G	G	--			G	G	G
<i>wrightii</i>	--			P	F	G	F	G	G	--			--		
<i>Stipa columbiana</i>	--			--			--			--			F	P	O
<i>comata</i>	--			--			--			--			F	F	P
<i>viridula</i>	--			--			--			--			F	F	P
<i>Tridens albescens</i>	--			F	O		F	F	P	--			--		
<i>elongata</i>	--			G	X		G	F	P	--			--		

<sup>1</sup> KEY TO SYMBOLS:

O = Failure

P = Poor

F = Fair

G = Good

E = Excellent

X = Destroyed by rabbits or rodents

-- = Not adequately tested (stand did not rate fair or better within 1 year after seeding)

\* = Damaged by insects, rabbits, rodents, or deer



Andropogon ischaemum maintained good stands throughout the years at the Corona site. Two other species of Andropogon--A. barbinodis and A. caucasicus--survived as fair stands at the Fort Bayard site. These species were never adequately tested at the other sites.

Atriplex canescens survived and grew well at all five sites. Stands produced from seed collected near Taos generally rated higher than stands from seed collected near Las Cruces.

Three strains of Bouteloua gracilis persisted at the Monica, Corona, and Taos Junction sites. The commercial source (Kansas) generally was poorer than the Capulin and Lovington strains. B. curtipendula survived as a fair stand at the Corona site, but for unknown reasons was never successfully established by seeding at the Fort Bayard site, where it grows in abundance naturally.

Eragrostis chloromelas and E. curvula survived at the Fort Bayard site but failed at the other sites. A stand of E. trichodes at Corona that rated good in 1950 declined to a poor stand in 1962. E. lehmanniana failed to survive at any of the study sites; good stands of seedlings usually emerged soon after planting, but these consistently died the following winter except at Fort Bayard.

A number of the species tested appeared to be adapted to only one of the five study sites. Some of these species never were adequately tested at the other sites, whereas some species developed good stands that died out because of drought or cold weather. Examples are the Eragrostis species at Fort Bayard discussed above. Other examples are Hilaria jamesii and Panicum obtusum, species which rated fair at Corona, and Oryzopsis hymenoides, which rated fair at Taos Junction.

Melilotus officinalis produced fair to good stands at three sites but did not reseed itself. By 1962 no plants of this species were found at any of the study sites.

Muhlenbergia wrightii was the outstanding grass at the Glorieta Mesa, Monica, and Corona sites in 1950. Twelve years later,

gophers had destroyed the test plots at the Glorieta Mesa site and only fair stands remained at the other two sites.

Secale montanum rated fair at four sites in 1950 but had completely disappeared by 1954. This grass produced a large volume of herbage for a few years, and may be useful for certain situations even though it is short lived.

Three species of Sporobolus rated high in 1962. Good stands of S. airoides and S. wrightii remained at the Monica and Corona sites. Stands of S. cryptandrus rated good at Corona and Taos Junction and fair at Monica.

Stipa species developed fair stands at the Taos Junction site. S. comata and S. viridula declined from fair to poor in adaptability ratings during the 8 years from 1954 to 1962, while S. columbiana disappeared.

Two species of Tridens were growing as fair stands at Corona in 1954 but declined to poor stands by 1962.

### Conclusions

The following species seem to warrant special consideration for seeding pinyon-juniper ranges. These are species that in 1962 rated good at one or more, or fair at two or more, of the study sites:

Agropyron desertorum  
A. sibiricum  
A. smithii  
Andropogon ischaemum  
Atriplex canescens  
Bouteloua gracilis  
Elymus junceus  
Muhlenbergia wrightii  
Sporobolus airoides  
S. cryptandrus  
S. wrightii

The Agropyron species and Elymus junceus probably are primarily adapted to areas where big sagebrush grows or where winter precipitation is relatively abundant. The other species listed appear better adapted to other areas in the pinyon-juniper type.